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LIDAR data to support coastal erosion analysis: the Conero study case

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In the last decades, the topic of coastal erosion and the derived risk have been subject of a growing interest for public authorities and researchers. Recent major natural events, such as hurricanes, tsunamis, and sea level rising, called the attention of media and society, underlining serious concerns about such problems. In a high-density populated country such as Italy, where tourism is one of the major economic activities, the coastal erosion is really a critical issue. In April 2010, along a reach of the coast of Ventotene Island, two young students tragically died, killed by a rock fall. This event dramatically stressed public authorities about the effectiveness of structural and non-structural measures for the mitigation of such phenomena. It is clear that an improving of the actual knowledge about coastal erosion is needed, especially to monitor such events and to set alert systems. In the last few years, airborne LIDAR technology led to a dramatic increase in terrain information. Airborne LiDAR and Terrestrial Laser Scanner (TLS) derived high-resolution Digital Terrain Models (DTMs) have opened avenues for hydrologic and geomorphologic studies (Tarolli et al., 2009). In general, all the main surface processes signatures are correctly recognized using a DTM with cell sizes of 1 m. Having said that, some sub-meter grid sizes may be more suitable in those situations where the analysis of micro topography related to micro changes due to slope failures is critical for risk assessment, and the Terrestrial Laser Scanner (TLS) has been proven to be a useful tool for such detailed field survey. The acquired elevation data with TLS allow to derive a centimeters high quality DTMs. The possibility to detect in detail the slope failures signatures results in a better understanding and mapping of the erosion susceptibility, and of those areas where slope failures are more likely to happen. In addition, these information can be also considered as the basis to develop risk maps. At this regard, a clear example is the case of coastal erosion.
In this work a detailed TLS survey was carried out in summer 2012, in the Conero Regional Park (Marche, province of Ancona), along the “spiaggia Urbani” and “spiaggia San Michele”. These two study areas present several sections affected by erosion, rock falls and slope failures. They are also a part of a very prestigious place for tourism during the summer season; therefore deriving risk maps is critical. Thanks to the TLS survey, it was possible to obtain a 10 cm resolution DTM covering a reach of about 1.5 km of the coast. This high resolution DTM was used to derive topographic attributes such as curvature from which it has been possible to automatically recognize (Tarolli et al, 2012) and map the surface features related to any surface instabilities. These topographic information and results will also serve as the reference point for future yearly TLS surveys, that absolutely will help in recognizing any micro changes and slope failures, improving the delineation of risk maps.

References

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